Long-term monitoring of carotid stents. Are they still in operation after 10 years?

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Authors: A. M. Molinos Urien, E. Garcia Garrigos, J. I. Gallego León, F. Ballenilla Marco, L. Jaques Pérez, M. D. Pascual Robles; Alicante/ES
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Purpose

Endovascular procedures constitute an emerging alternative treatment for extracranial carotid pathology, but the delayed efficacy is controversial.

This retrospective study analyzes the experience in our Centre in patients with cervical carotid stenting implanted 10 or more years ago. We review the literature and discuss clinical and radiologic results.
Methods and Materials

We searched our database for cases referred for carotid angioplasty or stenting before 1998.

Patient population

Before 1998 we performed 37 carotid stentings in 36 patients. Patients were referred for diagnostic angiography after extensive neurological investigation and non-invasive carotid doppler sonography. Treatment criteria, according to current approved guidelines, included asymptomatic patients with stenosis greater than 80% or greater than 60% for symptomatic patients. Stenosis grade was assessed according to NASCET criteria. Only one patient was referred for treatment not fullfilling this criteria but for an iatrogenic pseudoaneurysm.

Procedure

Therapeutic procedures were performed by two neuroradiologist from our Unit under conscious sedation and patient monitoring by an anaesthetist. All the procedures were performed after a diagnostic angiography which confirmed the carotid stenosis diagnosed by non-invasive techniques (Ultrasound Doppler). This study was used to plan the treatment and choose the required material.

Carotid revascularization was done without embolic protection system (not available at this time).

Follow-up

We collected clinical and radiologic evaluations of the patients at short (<= 3 years), middle (3 to 5 years), long (5 to 9 years) and very long time (>= 10 years).
Results

RESULTS

A total of 36 patients were identified retrospectively in our Database (31 males and 5 females with ages at the time of the stenting between 55 and 79 years (average 69 y.), with extracranial carotid stenting a decade ago. One patient had bilateral treatment, making up for a total of 37 stents.

Carotid stenosis severity range from 80 to 98% of the lumen size. 12 patients had previous history of neurologic ischaemic events (transient ischaemic attacks (TIA's) and 21 brain infarcts). 2 of the cases was an asymptomatic carotid stenosis, and one is performed because an iatrogenic pseudoaneurysm.

Clinical and radiographic follow-up was reviewed at short, middle, long and very long times, focusing on new thromboembolic events and stent permeability. (see table 1 and 2)

From the 36 patients, 19 have clinical or radiological informations at the short period (1-3 y), 13 at the middle (3-5), 12 at long (5-9) and 16 at very long time.

From the 10 patients radiological studied on very long term, only one significant re-stenosis (fig 1) and one occlusion was diagnosed. The remaining 8 cases show correct patency of the stent and normal flow rates (fig 2). Interestingly the only occlusion stent was the only one performed not for carotid stenosis but for pseudoaneurysm (fig 3). The restenosis case was diagnosed on long time period and remain unchanged since then.

Clinically we found 5 adverse cardioembolic events (4 IAM, 0 Strokes, 1 Isq MMII).

At the end point, 15 patients are dead, 2 from oncologic diseases and the information for the remaining 13 is not available. 7 patients are still alive but for many different reasons (elderly, moved to other region/country, etc.) refused to complete a medical and ecographic control. We lost for follow-up 4 patients. So that only 10 of the 36 (27.8%) initial patient was interviewed.

DISCUSSION
Angioplasty and stenting is a technique each day more present in medical practice, as an alternative to endarterectomy for the treatment of extracranial carotid stenosis. The rates of efficacy and morbi-mortality are nowadays accepted as similar to those of surgical carotid repair. Nevertheless there is no much experience about the durability of the procedure. Very few series have evaluated the clinical status and the radiological patency of the stents on long term. To our knowledge this question is still not definitively clarified in the literature, so that the aim of our study is reviewing our own background focusing on cardio-vascular complications and radiological features of the carotid stents implanted more than a decade ago.

As all study of retrospective character exists slanted and inherent methodologic problems. The data bases to which we have access have undergone several informatics updates hanging part of the information of the oldest cases. This is agravated by the fact of being our unit the only one of reference the treatment to neuro-endovascular of all the province, for that reason we work like a tertiary hospital. Once made the intervention the patients return for control and noninvasive pursuit in their local hospitals of origin.

Cohorte of patients that goes to ATP+Stent presents/displays generally a complex clinical context with numerous factors of cardiovascular risk and severe comorbidities, that doubtlessly influence in the expectations and quality of life of these patients. In addition the average age to which the procedure is made to them is very outpost (around 69 years old).

With these data we could explain the number of patients included in "lost for follow-up" and "alive" categories (very aged, demotivated, entered in institutions, pluripatologies) as well as part of the deceased.

80% of stents reviewed after 10 years do not present/display alterations. If we excluded the case from the occlusion whose indication was not by athero-embolic disease but by pseudoaneurysm, with which the percentage of complications in the preventive context of disease to cerebrovascular is in fact of 11%, indicating a highest level of patency to very long term.

The little number of embolic events in the pursuit speaks in favor of an effective level of elevated protection. Therefore these findings even confirm angioplasty and positioning of stent like a safe and effective technique to very long term. Considering these results the argument of the long life expectancy like determining a decisive factor/at the time of indicating the surgical repair of a carotid estenosis instead of the route does not seem to us just to endovascular.
Fig. 1: 79 year old woman with high grade stenosis of the left internal carotid. A, B: Angiography showing high grade stenosis of the left internal carotid, and stenting image. C, D, E: Color Doppler ultrasound: occlusion with 50% stenosis of the stent in the long-term monitoring.

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Fig. 2: 64 year old woman with left internal carotid 95% stenosis. A, B, C: Images from angiography before and after stenting. D, E: Doppler ultrasound of very long-term follow-up, showing a right carotid flow. F: Sagittal MIP Reconstruction of a CT angiography control, showing normal stent morphology.

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Fig. 3: 62 year old male. The stent was placed by pseudoaneurysm of the left carotid bulb. A, B: Angiography shows a pseudoaneurysm in the left carotid bulb. C: Image of the left carotid stenting. D, E: color Doppler ultrasound showing occlusion of the stent in the long-term monitoring.

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Table 1: Short-term follow: Track 1-3 years after carotid stenting. Medium-term follow: Track 3-5 years after carotid stenting. Long-term monitoring: Track 5-9 years after carotid stenting. Very long-term monitoring: Monitoring # 10 years after carotid stenting. OK: Patients who are clinically and radiologically well after carotid stenting. XXXX: Patients with loss monitoring. VIVO: Patients who are alive after more than 10 years of carotid stenting. Est: stenosis. IAM: acute myocardial infarction. IAMMII: acute peripheral ischemia of the lower limbs. †: Deceased. (continued in Table 2)

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Table 2: Table 2: Short-term follow: Track 1-3 years after carotid stenting. Medium-term follow: Track 3-5 years after carotid stenting. Long-term monitoring: Track 5-9 years after carotid stenting. Very long-term monitoring: Monitoring # 10 years after carotid stenting. OK: Patients who are clinically and radiologically well after carotid stenting. XXXX: Patients with loss monitoring. VIVO: Patients who are alive after more than 10 years of carotid stenting. Est: stenosis. IAM: acute myocardial infarction. IAMMI: acute peripheral ischemia of the lower limbs. †: Deceased.

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Conclusion

Carotid stenting for extracranial carotid stenosis is a safe, effective and durable treatment and could be an option even in patients with large life expectancy.
References

**Personal Information**

**A. M. Molinos Urien** M. D. Unidad de Radiodiagnóstico. Hospital General Universitario de Alicante.

**E. García Garrigos** M. D. Unidad de Radiodiagnóstico sección TC. Hospital General Universitario de Alicante.

**J. I. Gallego León** M.D. Unidad de Neurorradiología Diagnóstica y Terapéutica. Hospital General Universitario de Alicante.

Mailing address: C/ Maestro Alonso, 109. 03010 Alicante.

e-mail: jigl8@hotmail.com

**F. Ballenilla Marco** M.D. Unidad de Neurorradiología Diagnóstica y Terapéutica. Hospital General Universitario de Alicante.

**L. Jaques Pérez** M. D. Unidad de Radiodiagnóstico. Hospital General Universitario de Alicante.

**M. D. Pascual Robles** M. D. Unidad de Radiodiagnóstico. Hospital General Universitario de Alicante.